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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/584,047	08/11/2008	Herve Toulhoat	PET-2254	6857
7590	05/13/2011	Millen, White, Zelano & Branigan 2200 Clarendon Boulevard Suite 1400 Arlington, VA 22201	EXAMINER WONG, EDNA	
			ART UNIT 1759	PAPER NUMBER
			MAIL DATE 05/13/2011	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/584,047	Applicant(s) TOULHOAT ET AL.
	Examiner EDNA WONG	Art Unit 1759

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 03 May 2011.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 3-11, 18, 19, 21, 23 and 24 is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1,2,12-17,20,22 and 25-27 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Factual Drawing Review (PTO-946)
- 3) Information Disclosure Statement(s) (PTO/SB/08)
 Paper No./Mail Date June 22, 2006
- 4) Interview Summary (PTO-413)
 Paper No./Mail Date _____
- 5) Notice of Informal Patent Application
- 6) Other: _____

Election/Restrictions

Applicant's election with traverse of species A(i), B(i) and C(i) in the reply filed on May 3, 2011 is acknowledged. The traversal is on the ground(s) that a process for sequestering carbon emitted into the atmosphere in the form of CO₂ by capturing the carbon dioxide, converting it to oxalic or formic acid in the aqueous phase and then mineralizing the oxalic or formic acid with a compound of element M so as to produce a mineral in which the atomic ratio C/M is about 2/1. This is not found persuasive because the Examiner has found the elected species unpatentable over the prior art and the prior art cannot be applied to the other species because they are not obvious variants.

The requirement is still deemed proper and is therefore made FINAL.

Accordingly, claims **3-11, 18-19, 21 and 23-24** are withdrawn from consideration as being directed to a non-elected invention.

Claim Objections

Claim **1** is objected to because of the following informalities:

Claim 1

line 6, the word -- acid -- should be inserted after the word "oxalic". See claim 1, line 7.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

I. Claims 1-2, 12-17, 20, 22 and 25-27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1

line 2, the word "it" is indefinite.

line 3, "the liquid phase" lacks antecedent basis.

lines 4-5, recite "a step for electro-reduction in an aprotic medium to a compound in which the carbon changes to oxidation number +3 in the form of oxalic acid or formic acid." It is unclear from the claim language what is being electro-reduced in the aprotic medium.

line 5, "the form of oxalic acid or formic acid" lacks antecedent basis.

Antecedent basis must be laid for each recited element in a claim, typically, by introducing each element with the indefinite article ("a" or "an"). See *Slimfold Mfg. Co. v. Kincaid Properties, Inc.*, 626 F. Supp 493,495 (N.D. Ga. 1985), aff'd, 810 F.2d 1113 (Fed. Cir. 1987) (citing P. Rosenberg, 2 *Patent Law Fundamentals*' § 14.06 (2d. Ed. 1984)). Subsequent mention of an element is to be modified by the definite article "the", "said" or "the said," thereby making the latter mention(s) of the element unequivocally

referable to its earlier recitation.

line 6, "re-extracting" lacks antecedent basis. There is no extracting step recited in the claim in order to re-extract.

line 6, it appears that the "oxalic acid or formic acid" is the same as the form of oxalic acid or formic acid recited in claim 1, line 5. However, the claim language is unclear as to whether it is.

line 6, "the aqueous phase" lacks antecedent basis.

line 8, the definition of "M" is missing in the claim.

line 8, the definition of "C" is missing in the claim.

Claim 2

line 2, it appears that the "CO₂" is the same as the CO₂ recited in claim 1, line 3. However, the claim language is unclear as to whether it is. The subsequent mention of an element is to be modified by the definite article "the", "said" or "the said," thereby making the latter mention(s) of the element unequivocally referable to its earlier recitation.

Claim 16

line 2, it appears that the "oxalic acid" is the same as the oxalic acid recited in claim 1, line 5. However, the claim language is unclear as to whether it is. The subsequent mention of an element is to be modified by the definite article "the", "said" or "the said," thereby making the latter mention(s) of the element unequivocally referable to its earlier recitation.

line 2, it is unclear how the compound from electro-reduction step b) can comprise an oxalate when in steps (c) and (d) recites using the oxalic acid.

Claim 20

line 1, 'the final mineralization step" lacks antecedent basis.

lines 2-3, if the electro-reduction step b) is in an aprotic medium (from claim 1, lines 4-5), then how is an aqueous solution of oxalic acid or formic acid coming from the electro-reduction step b)?

Claim 22

line 2, "the mineral formed" should be amended to -- the mineral produced -- since claim 1, line 8, recites "producing a mineral."

Claim 26

line 1, "the final mineralization step" lacks antecedent basis.

lines 2-3, the electro-reduction step b) is in an aprotic medium (from claim 1, lines 4-5), then how is an aqueous solution of oxalic acid or formic acid coming from the electro-reduction step b)?

II. Claims 1-2, 12-17, 20, 22 and 25-27 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: between steps (a) and (b)-(d).

Claim 1

lines 1-9, recite:

A process for sequestering carbon emitted into the atmosphere, characterized in that it comprises:

- a) a step for concentrating CO_2 in the liquid phase;
- b) a step for electro-reduction in an aprotic medium to a compound in which the carbon changes to oxidation number +3 in the form of oxalic acid or formic acid;
- c) if appropriate, a step for re-extracting oxalic or formic acid in the aqueous phase; and
- d) a step for mineralization by reacting said oxalic acid or formic acid with a compound of an element M, producing a mineral in which the atomic ratio C/M is about 2/1.

Once the CO_2 is concentrated in the liquid phase, what happens to it?

III. Claims 1-2, 12-17, 20, 22 and 25-27 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: between the carbon emitted into the atmosphere and a compound in which the carbon changes to oxidation number +3.

Claim 1

lines 1-9, recite:

A process for sequestering *carbon emitted into the atmosphere*, characterized in that it comprises:

- a) a step for concentrating CO₂ in the liquid phase;
- b) a step for electro-reduction in an aprotic medium to *a compound in which the carbon changes to oxidation number +3* in the form of oxalic acid or formic acid;
- c) if appropriate, a step for re-extracting oxalic or formic acid in the aqueous phase; and
- d) a step for mineralization by reacting said oxalic acid or formic acid with a compound of an element M, producing a mineral in which the atomic ratio C/M is about 2/1.

"The carbon" in step (b) is the subsequent mention of the carbon emitted into the atmosphere, hence the word "the". How did the carbon end up in the compound if it is emitted into the atmosphere?

IV. Claims 1-2, 12-17, 20, 22 and 25-27 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative

relationships are: between the compound and the oxalic acid or formic acid.

Claim 1

lines 1-9, recite:

A process for sequestering carbon emitted into the atmosphere, characterized in that it comprises:

- a) a step for concentrating CO₂ in the liquid phase;
- b) a step for electro-reduction in an aprotic medium to *a compound* in which the carbon changes to oxidation number +3 *in the form of oxalic acid or formic acid*;
- c) if appropriate, a step for re-extracting *oxalic or formic acid* in the aqueous phase; and
- d) a step for mineralization by reacting *said oxalic acid or formic acid* with a compound of an element M, producing a mineral in which the atomic ratio C/M is about 2/1.

Step (b) produces a compound in the form of oxalic acid or formic acid, however, step (c) re-extracts oxalic or formic acid and (d) reacts said oxalic or formic acid. The *form of* oxalic or formic acid is not necessarily oxalic or formic acid.

V. Claims 15 and 25-27 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: between the liquid CO₂ under pressure and the concentrated CO₂ in the liquid phase.

Claim 1, line 3, recites "a step for concentrating CO₂ in the liquid phase."

Claim 15, line 2, recites "is carried out in liquid CO₂ under pressure."

Claim 25, lines 1-2, recites "is carried out in liquid CO₂ under pressure."

Are the liquid CO₂'s related? Are they the same thing?

VI. Claim 17 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: between the non-aqueous medium and the aprotic medium.

Claim 1

lines 4-5, recite "a step for electro-reduction in an aprotic medium to a compound in which the carbon changes to oxidation number +3 in the form of oxalic acid or formic acid."

Claim 17

lines 1-2, recite "in which the oxalic acid or oxalate, obtained in a non-aqueous medium, is re-extracted by an aqueous phase."

Are the aprotic medium and non-aqueous medium both used in the step for electro-reduction? Are they the same thing?

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

I. Claims 1-2, 12-16, 22 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Abbott et al.** ("Electrochemical Reduction of CO₂ in a Mixed Supercritical Fluid", *J. Phys. Chem B* (2000), Vol. 104, pp. 775-779) in view of **CS 111531** ('531).

Abbott teaches a process for sequestering carbon emitted into the atmosphere, characterized in that it comprises:

- a) a step for concentrating CO₂ in the liquid phase (= the concentration of CO₂ in solution can be raised by increasing the CO₂ pressure) [page 775, right column, lines 40-42];
- b) a step for electro-reduction in an aprotic medium (= the electroreduction of CO₂ at Pt and Pb electrodes in supercritical CO₂/HFC 134a solvent mixtures) [page 776, left column, lines 54-56] to a compound in which the carbon changes to oxidation number +3 in the form of oxalic acid or formic acid (= the formate and oxalate content of the bulk electrolysis product) [page 777, left column, lines 11-13]; and
- c) if appropriate, a step for re-extracting oxalic or formic acid in the aqueous phase.

Step a) for concentration in the liquid phase comprises liquefying CO₂, the liquid CO₂ then being obtained under pressure, the supercritical state (= the concentration of

CO₂ in solution can be raised by increasing the CO₂ pressure) [page 775, right column, lines 40-42].

The anode used in the electro-reduction step is constituted by platinum, diamond-doped with boron or carbon doped with nitrogen (= the outer stainless steel cylinder formed the anode and was platinized by standard technique) [page 776, right column, lines 22-23].

The electro-reduction step b) is carried out in liquid CO₂ under pressure (= the electroreduction of CO₂ at Pt and Pb electrodes in supercritical CO₂/HFC 134a solvent mixtures) [page 776, left column, lines 54-56].

The compound from electro-reduction step b) is comprises oxalic acid or an oxalate (= the formate and oxalate content of the bulk electrolysis product) [page 777, left column, lines 11-13].

The process of Abbott differs from the instant invention because Abbott does not disclose the following:

- a. A step for mineralization by reacting said oxalic acid or formic acid with a compound of an element M, producing a mineral in which the atomic ratio C/M is about 2/1, as recited in claim 1.
- b. In which the element M is calcium and the mineral formed is Whewellite, CaC₂O₄·H₂O, as recited in claim 22.

CS '531 teaches liquids containing sequestrates with Ca in a concentration

>0.014% by an equivalent of oxalic acid or an oxalate in the presence of a mineral acid. The Ca oxalate formed is removed the solution by slow crystallization at pH 3.9-5.0 (abstract).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Abbott by reacting said oxalic acid or formic acid with a compound of an element M because Ca in a concentration >0.014% by an equivalent of oxalic acid or an oxalate in the presence of a mineral acid would have formed Ca oxalate as taught by CS '531 (abstract).

As to producing a mineral in which the atomic ratio C/M is about 2/1, the Abbott combination teaches similar method steps as presently claimed (*i.e., concentrating, electro-reducing, mineralizing*). Similar processes can reasonably be expected to yield products which inherently have the same properties. *In re Spada* 15 USPQ 2d 1655 (CAFC 1990); *In re DeBlauwe* 222 USPQ 191; *In re Wiegand* 86 USPQ 155 (CCPA 1995).

Furthermore, the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

c. In which the electro-reduction step b) is carried out at a pH in the range of 3 to 10 and with an anode maintained at a potential of +0.5 to -3.5 volts with respect to the normal hydrogen electrode, as recited in claim 12.

d. In which the pH is in the range of 3 to 7, as recited in claim 13.

Abbott teaches 30.6 mol% 1,1,1,2-tetrafluoroethane (HFC 134a) in CO₂ mixture (ICI Klea group, 99.99%) and the electrolyte, tetrabutylammonium tetrafluoroborate (Fluka, electrochemical grade) [page 776, right column, lines 29-32]. The mixture disclosed by Abbott naturally has a pH, and it would have been either acidic, neutral or basic.

It has been held that changes in temperature, concentration or both, is not a patentable modification; however, such changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of the prior art, such ranges are termed "critical" ranges and Applicant has the burden of proving such criticality; even though Applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within capabilities of one skilled in the art; more particularly, where general conditions of the claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) and MPEP § 2144.05.

Abbott teaches an anode potential (page 776, Fig. 1: see the three leads coming out from the potentiostat). It would have been obvious to one having ordinary skill in the

art at the time the invention was made to have modified the anode potential described by Abbott with an anode maintained at a potential of +0.5 to -3.5 volts with respect to the normal hydrogen electrode because the anode potential is a result-effective variable and one having ordinary skill in the art has the skill to calculate the anode potential that would have determined the success of the desired reaction to occur (MPEP § 2141.03 and § 2144.05).

II. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Abbott et al.** ("Electrochemical Reduction of CO₂ in a Mixed Supercritical Fluid", *J. Phys. Chem B* (2000), Vol. 104, pp. 775-779) in view of **CS 111531** ('531) as applied to claims 1-2, 12-16, 22 and 25 above, and further in view of **Baniel et al.** (US Patent No. 4,275,234).

Abbott and CS '531 are as applied above and incorporated herein.

The process of Abbott differs from the instant invention because Abbott does not disclose in which the oxalic acid or oxalate, obtained in a non-aqueous medium, is re-extracted by an aqueous phase, as recited in claim 17.

Baniel teaches the recovery of acids from aqueous solutions. Baniel teaches:

100 g of a 2% w/w aqueous solution of oxalic acid was extracted in a separatory funnel with 35 g of an extractant containing 25% w/w dilaurylbenzylamine, 69% w/w of n-octane and 6% w/w of 1-n-octanol. After shaking at 40°C and phase separation, the aqueous raffinate was substantially free of oxalic acid. The extract contained 5.4% w/w of oxalic acid.

The extract was separated, diluted with a further 50 g of n-octane and heated to 80°C, and back-extracted with 30 g water heated to the same temperature. The oxalic acid was back-extracted almost completely. The organic extractant phase contained less than about 0.5% w/w oxalic acid (col. 9, Example 16).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the oxalic acid or oxalate described by Abbott with wherein the oxalic acid or oxalate, obtained in a non-aqueous medium, is re-extracted by an aqueous phase because back-extracting a non-aqueous phase with water would have been conventional in the recovery of an acid from an aqueous solution as taught by Baniel (col. 9, Example 16).

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter:

Claim 20 define over the prior art of record because the prior art does not teach or suggest a process according to claim 1, in which the final mineralization step comprises an attack of a carbonated mineral by an aqueous solution of oxalic acid or formic acid from the electro-reduction step (b).

Claims 26 and 27 define over the prior art of record because the prior art does not teach or suggest a process according to claim 25, in which the final mineralization step comprises an attack of a carbonated mineral by an aqueous solution of oxalic acid or formic acid from the electro-reduction step (b).

The prior art does not contain any language that teaches or suggests the above. Abbott et al. do not teach a final mineralization step comprises an attack of a carbonated mineral by an aqueous solution of oxalic acid or formic acid from the

electro-reduction step (b). Therefore, a person skilled in the art would not have been motivated to adopt the above conditions, and a *prima facie* case of obviousness cannot be established.

Claims 20 and 26-27 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EDNA WONG whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey T. Barton can be reached on (571) 272-1307. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Edna Wong/
Primary Examiner
Art Unit 1759

EW
May 11, 2011